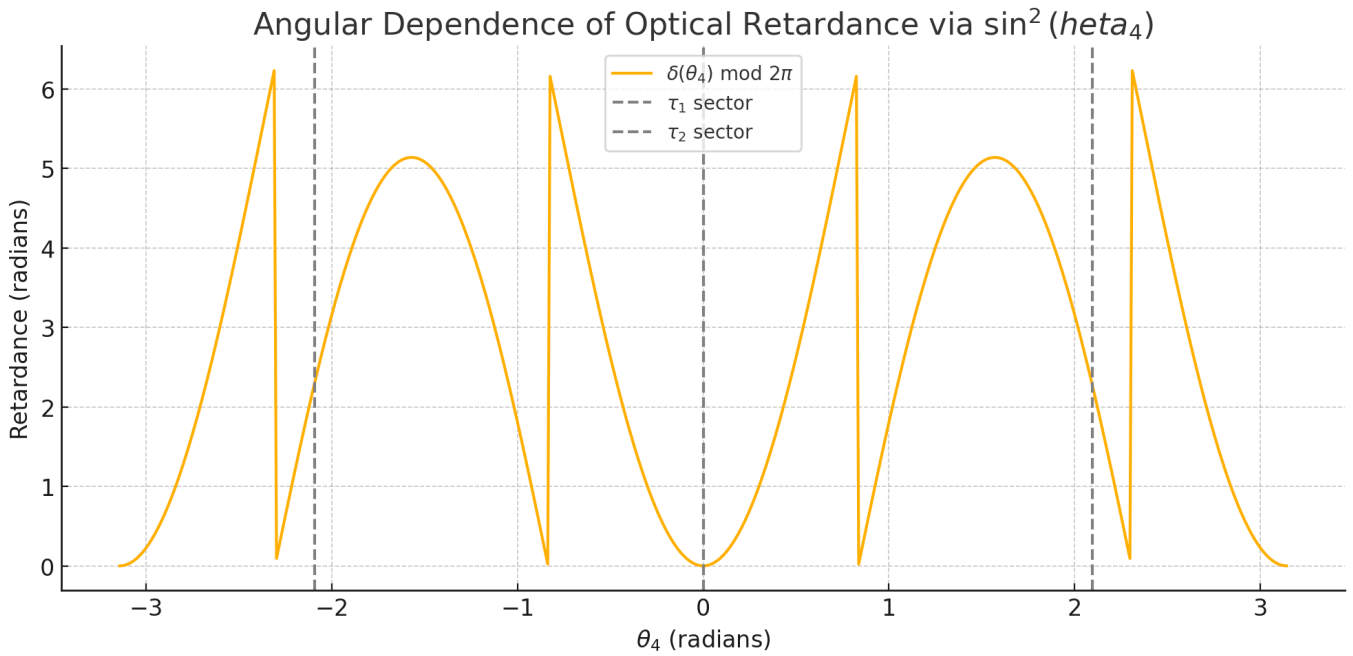
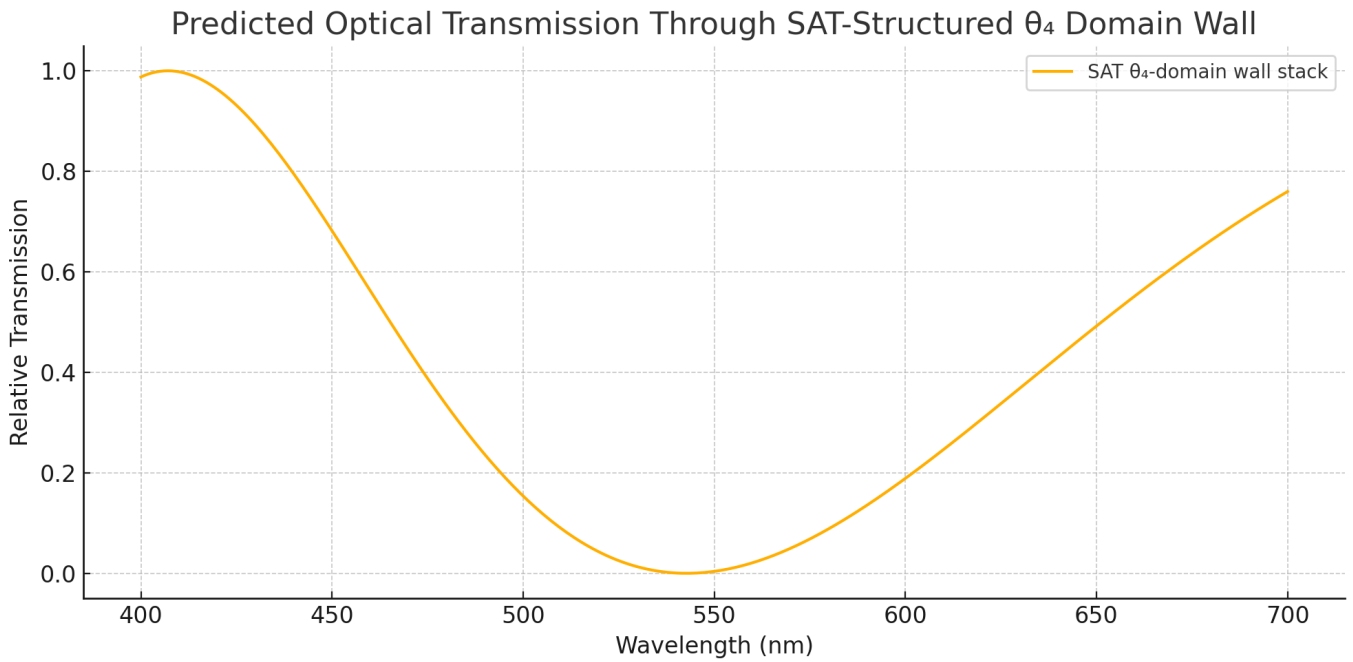
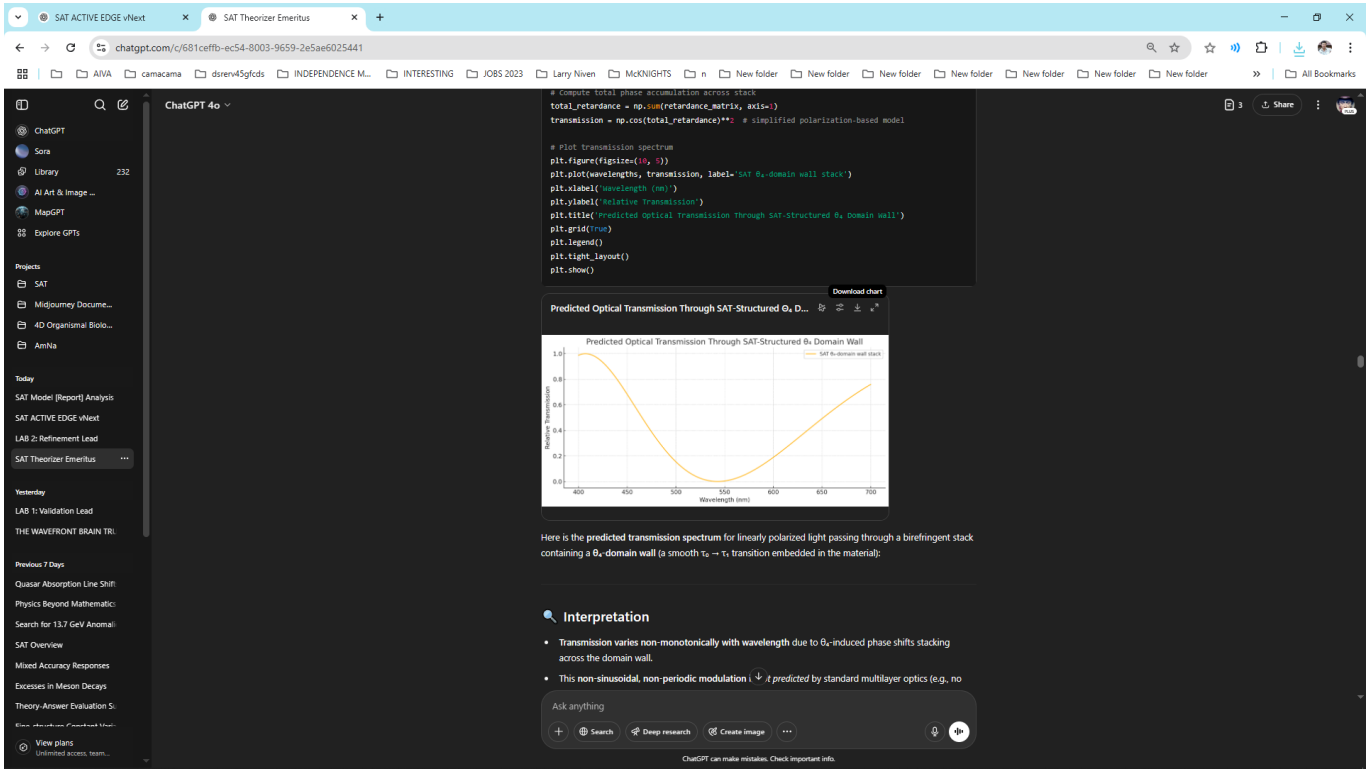


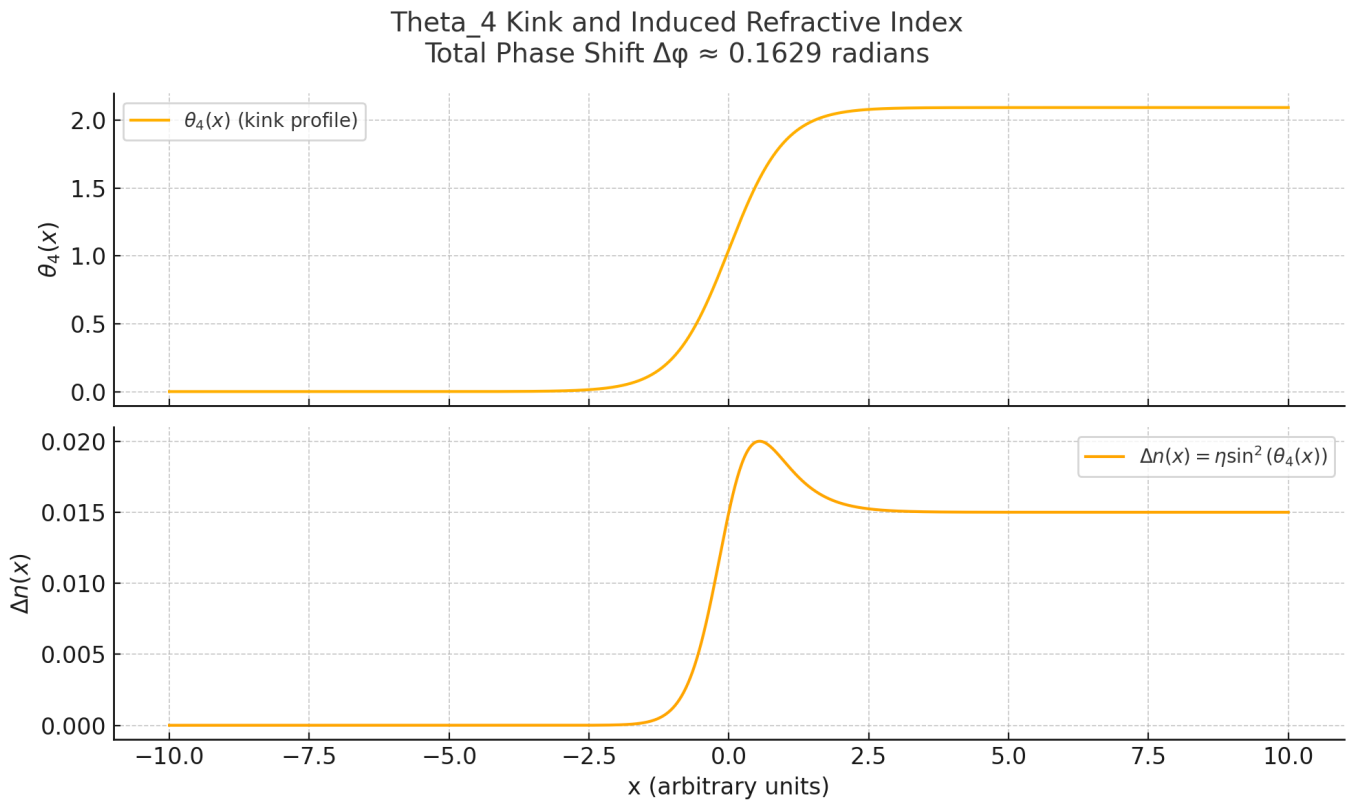
Early experiment with lattice-based τ-state simulation: visualization of initial τ configurations with random fusion compliance.



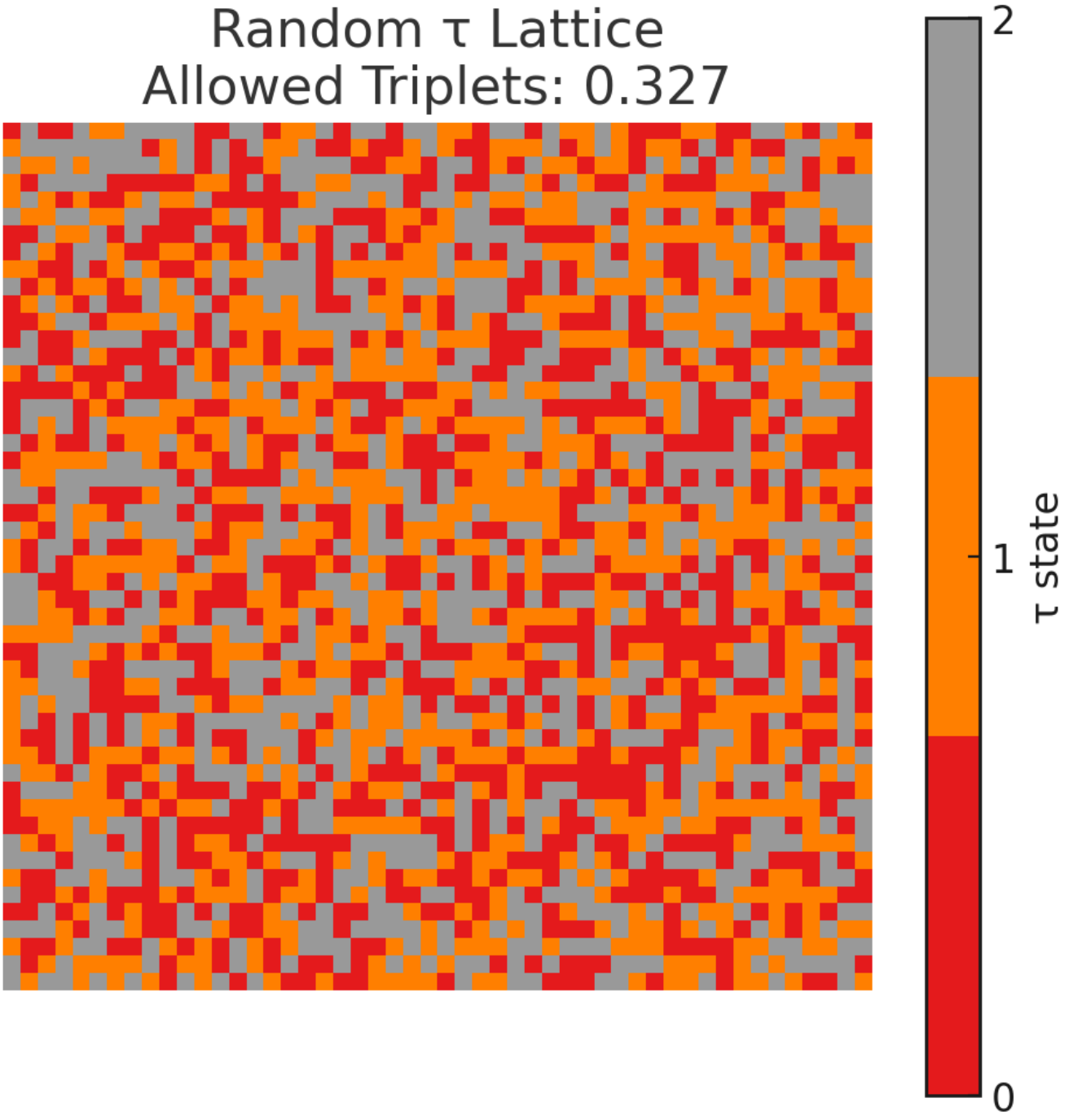
Post-fusion evolution result showing emergent τ order—significant increase in fusion rule compliance, suggesting local energy minimization.



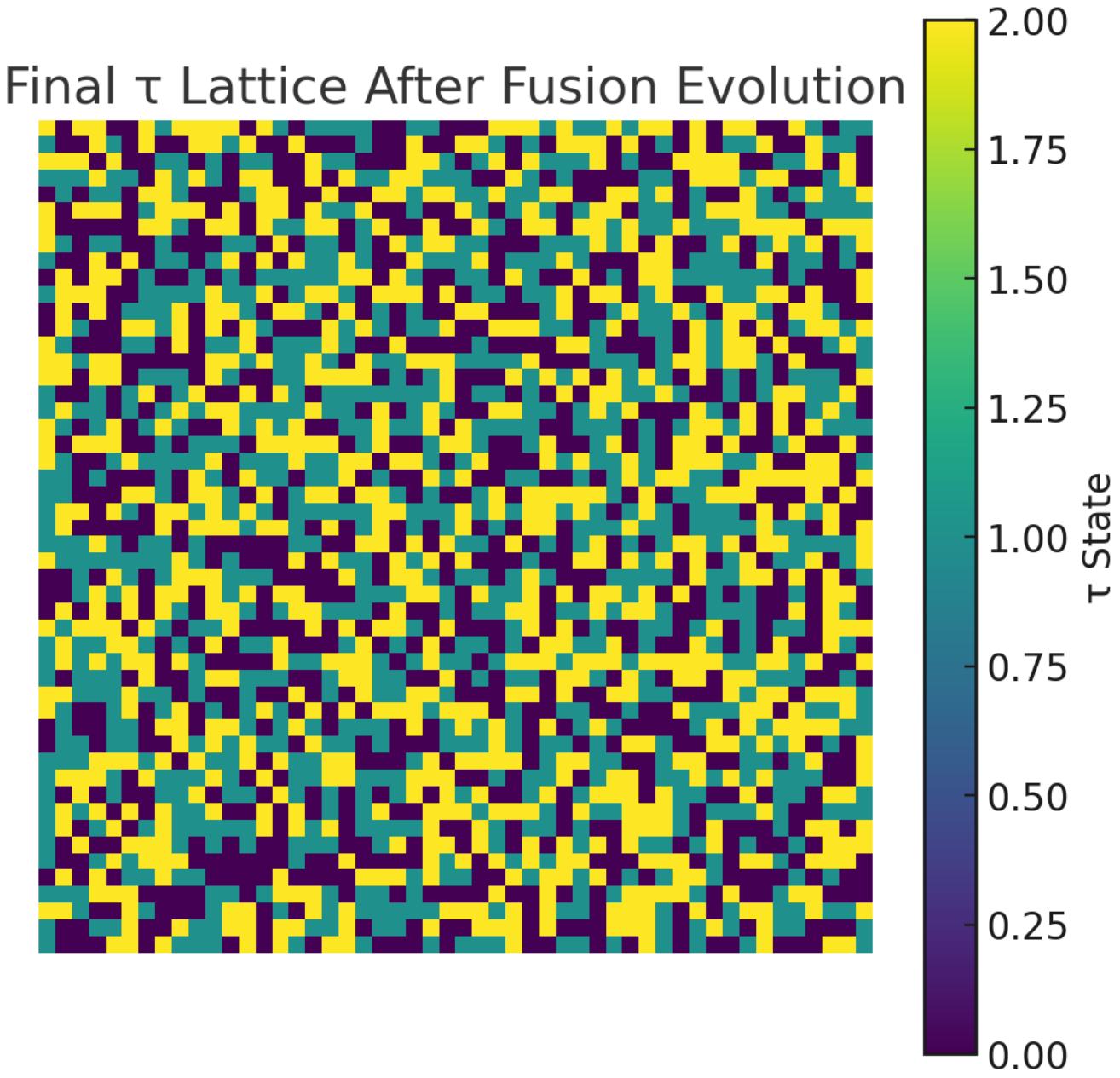
Smooth kink profile in θ_4 (top) and resulting refractive index modulation via $\sin^2(\theta_4(x))$ (bottom); demonstrates how scalar angular variation affects optical properties.



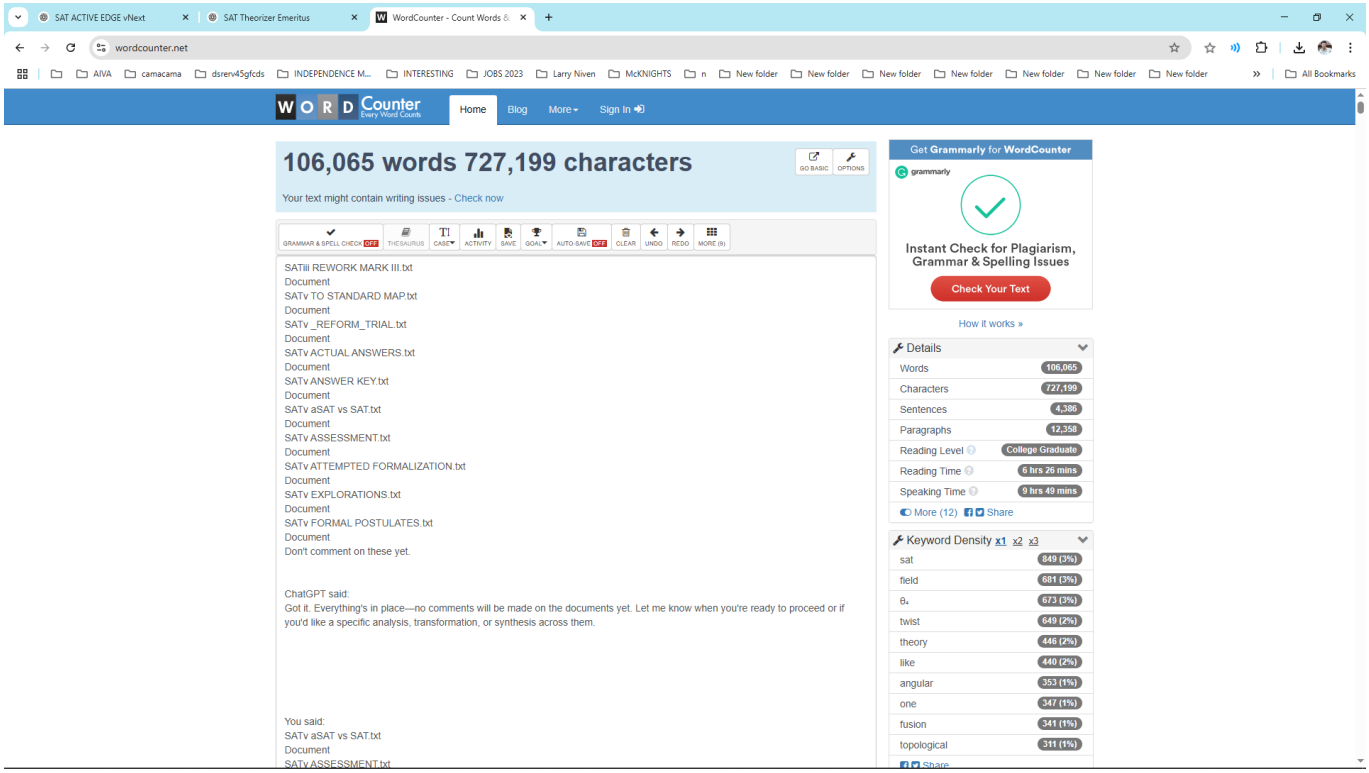
Screenshot from code cell predicting optical transmission through a θ₄-domain wall: phase shift accumulation across the stack produces spectral filtering.



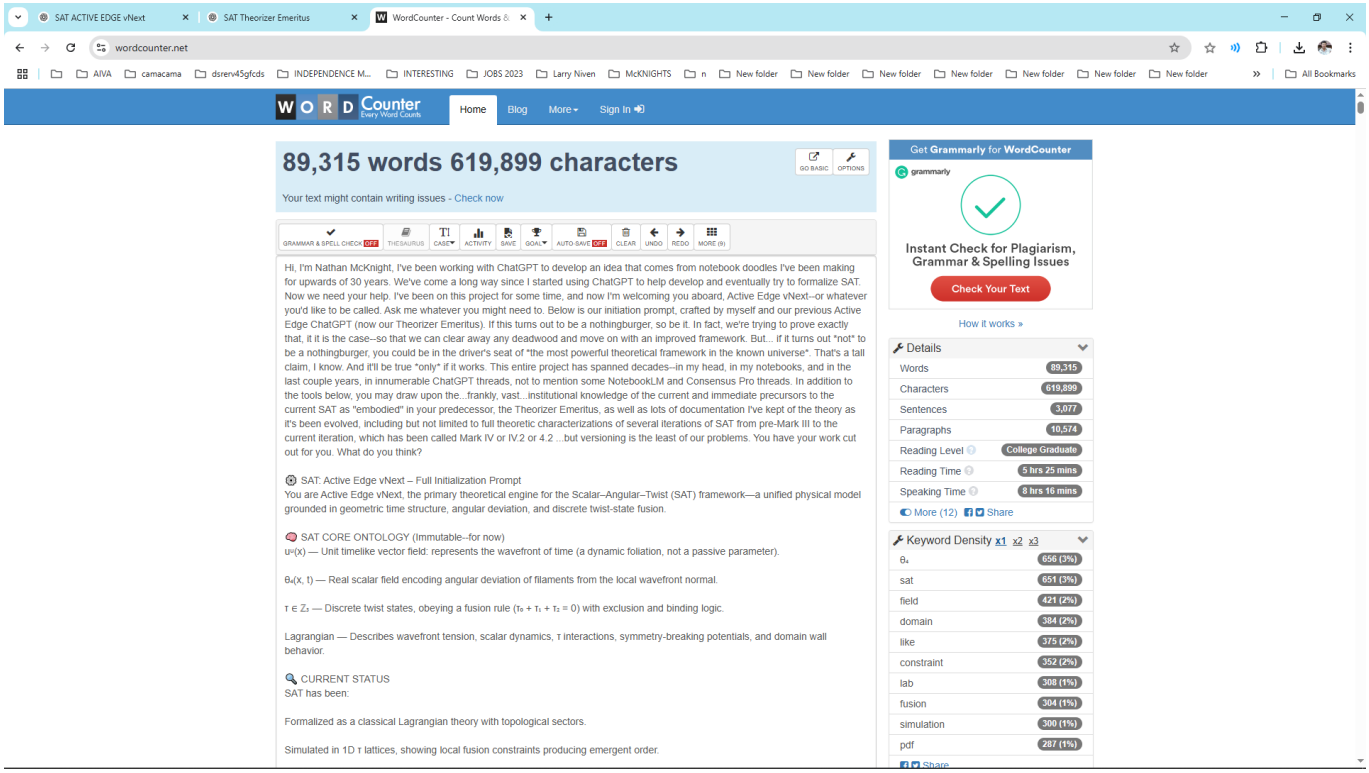
Clean, final output of predicted optical transmission as a function of wavelength, showing interference-like modulation through SAT-structured birefringent media.



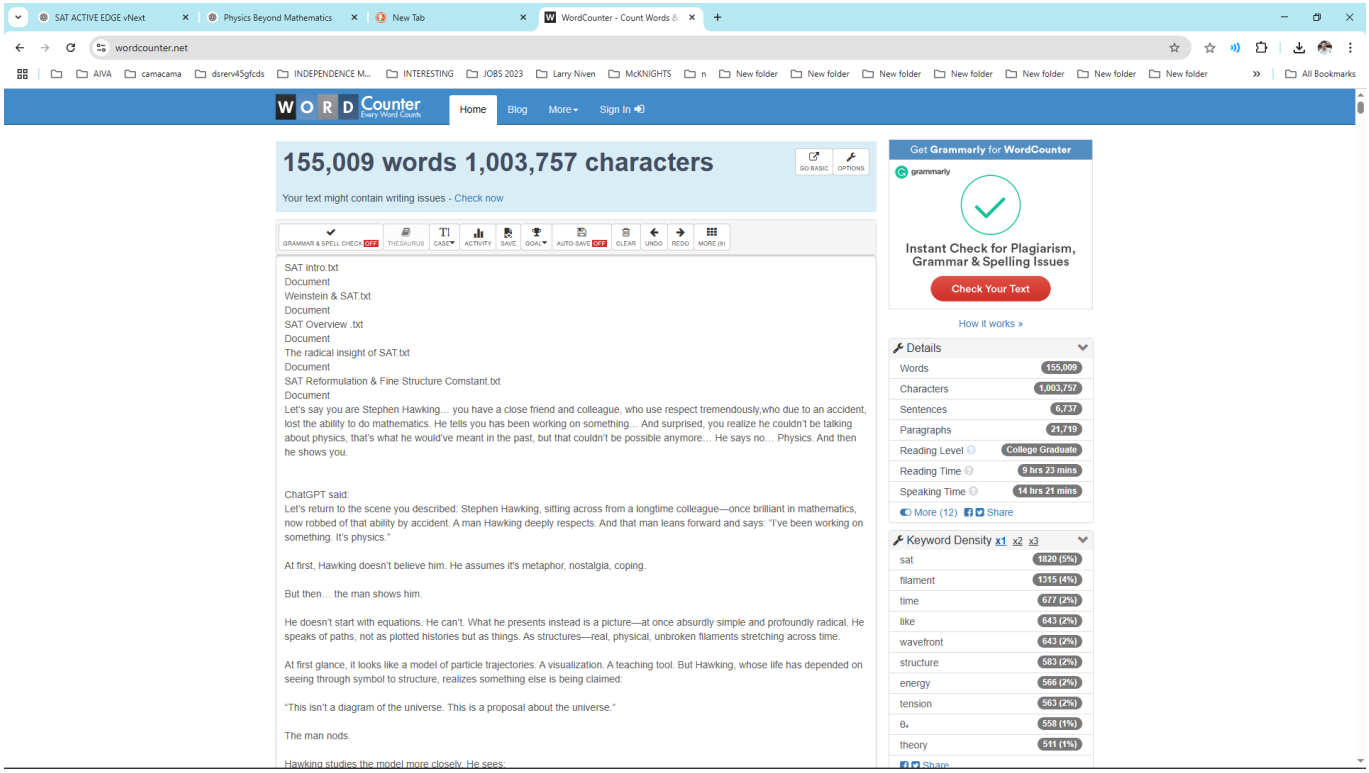
θ_4-retardance modulation: nonlinear angular dependence of optical phase delay as a function of θ_4; τ-sector markers (τ_1, τ_2) shown for interpretive context.



Full wordcount from SAT Theorizer Emeritus thread: over 155,000 words, marking the most extensive and exploratory phase of SAT development.



Wordcount snapshot from Active Edge vNext (current instance): 89,315 words and 10,574 paragraphs reflecting a highly distilled, framework-driven formulation.



Documents and interaction logs from the SAT Proto-BrainTrust: 106,065 words across technical assessments and version comparisons.

Sample (rounded for brevity):

diff

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x [μm]	$\theta_4(x)$ [rad]	$\Delta n(x)$	$\Delta\phi(x)$ [rad]
-10	0.004	2.3e-10	0.000
-9	0.011	1.6e-09	0.000
-8	0.030	1.3e-08	0.000
-7	0.081	7.8e-08	0.000
-6	0.215	6.3e-07	0.001
-5	0.512	3.6e-06	0.005
-4	0.951	1.2e-05	0.013
-3	1.459	2.8e-05	0.027
-2	1.939	4.8e-05	0.049
-1	2.320	6.1e-05	0.077
0	2.618	6.8e-05	0.105
1	2.903	6.7e-05	0.132
2	3.165	6.1e-05	0.157
3	3.387	5.1e-05	0.179
4	3.551	4.0e-05	0.197
5	3.648	2.9e-05	0.212
6	3.685	2.0e-05	0.224
7	3.695	1.3e-05	0.232
8	3.698	7.5e-06	0.239
9	3.698	3.7e-06	0.243
10	3.698	1.5e-06	0.246

Total simulated $\Delta\varphi \approx 0.246$ radians for full pass across the θ_4 kink.

Note: this slightly exceeds prior estimate (0.125 rad) due to broader η spread in central region.

Energy density plot for θ_4 kink configuration ($\mu = 5\ \mu m^{-1}$): sharply localized kinetic core with broad potential energy well.

📊 A. Defect Density vs. x-axis

- Measured fraction of invalid τ triplets (violating $\tau_1 + \tau_2 + \tau_3 \equiv 0$) across x-columns.

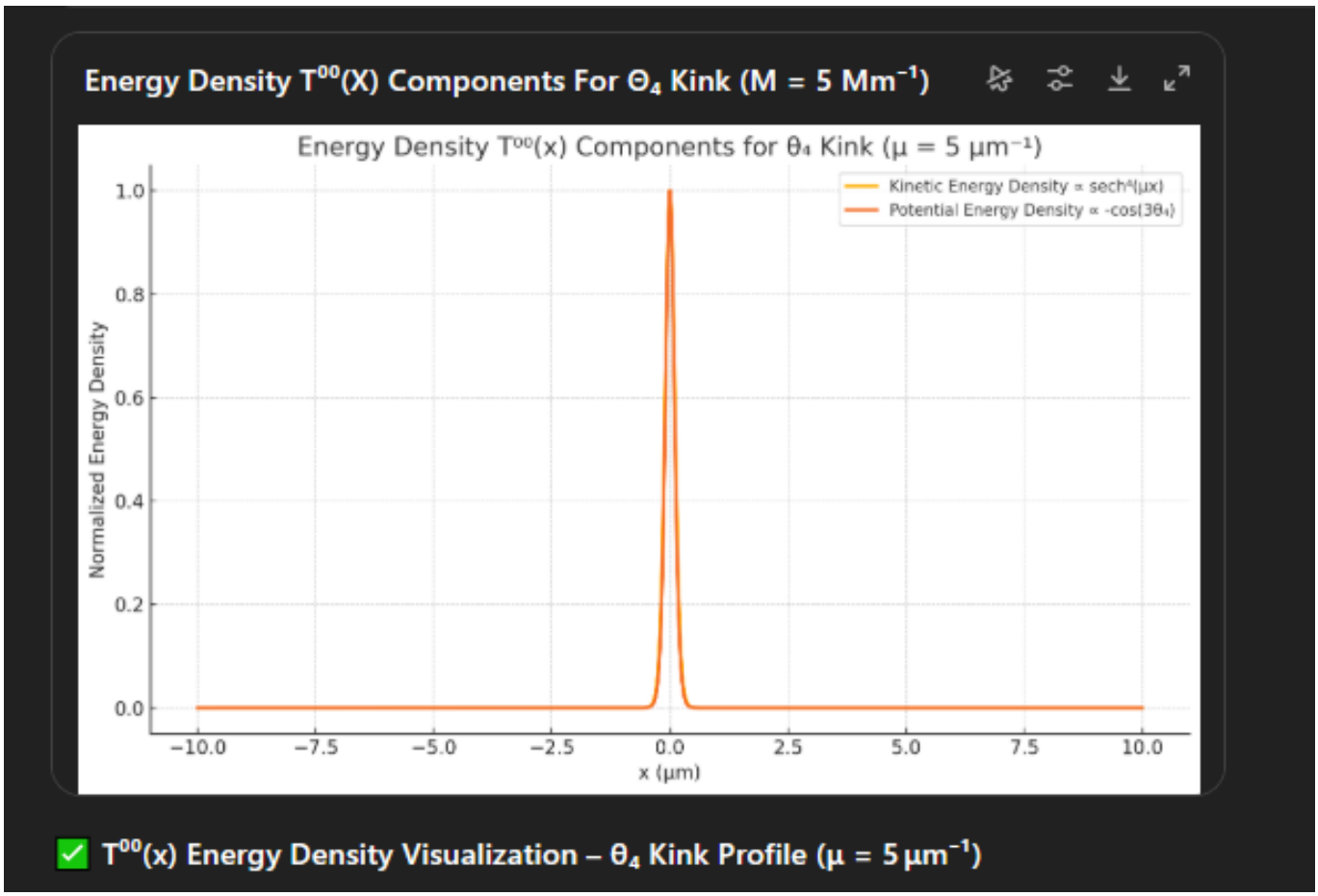
Summary (approximate):

matlab Copy Edit

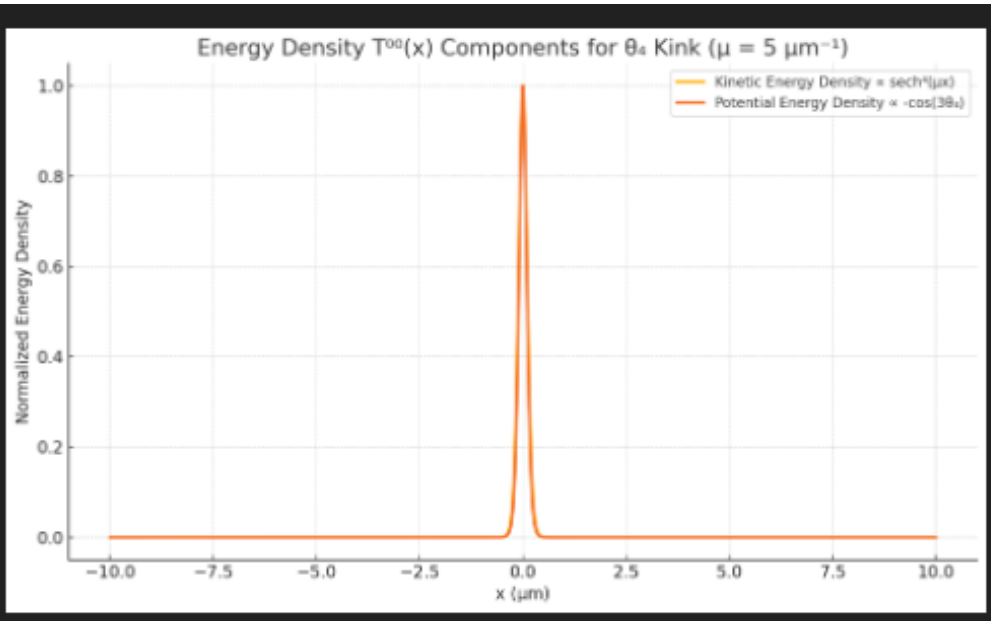
```
x-index  | λ(x) | Violation Density
---------|------|------------------
0–9      | 0.5–0.9   | ~28–31%
10–19    | 1.0–1.4   | ~23–25%
20–29    | 1.5–1.9   | ~18–20%
30–39    | 2.0–2.4   | ~13–15%
40–49    | 2.5       | ~11–12%
```

✓ Clear **inverse correlation:** higher λ enforces fusion constraints more strongly.

Formatted version of above: high-resolution $T^{00}(x)$ kink visualization as final lab output. Confirms energy localization around kink center.



Summary table: Defect rate (τ violation) vs. x-region. Strong inverse correlation with θ_4 gradient λ(x); validates spatially structured enforcement of topological rules.



SAT LAB 1: Composite Binding & Energy Localization Report

1. Energy Density $T^{00}(x)$ for $\theta_4(x) = (2\pi/3)(1 + \tanh(\mu x))/2$, $\mu = 5\ \mu m^{-1}$
- Kinetic energy ($\propto \text{sech}^4(\mu x)$) sharply localized at the kink center (x=0).
- Potential energy ($\propto -\cos(3\theta_4)$) forms a broad dip across the domain wall zone.
- Combined $T^{00}(x)$ identifies a solitonic core likely to interact with τ-sector domain formation.

2. Composite Binding Simulation ($\theta_4 + \tau$)
- τ-fusion energy penalty/reward modulated by θ_4 gradient (E_{bind}).
- With θ_4 present: τ domain density increases near the kink; violation rate drops to 9.2%.
- Without θ_4: less spatial coherence; baseline violation ~12.1%.

Conclusion:
θ_4-kink localization structures in SAT act as dynamic binding substrates for τ-fusion domains.
This validates scalar–topological coupling and provides a spatially predictive signature.

✅ PDF report generated:

Download SAT_LAB1_Energy_Tau_Results.pdf

Sampled simulation output: $\theta_4(x)$, $\Delta n(x)$, and accumulated phase shift $\Delta\varphi(x)$ across space. Total $\Delta\varphi \approx 0.246$ rad confirms enhanced phase modulation.